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Greater prevalence of post-traumatic stress disorder and depression in deployed Canadian Armed Forces personnel at risk for moral injury

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ACTA PSYCHIATRICA SCANDINAVICA

Greater prevalence of post-traumatic stress disorder and depression in deployed Canadian Armed Forces personnel at risk for moral injury

Nazarov A, Fikretoglu D, Liu A, Thompson M, Zamorski MA. Greater prevalence of post-traumatic stress disorder and depression in deployed Canadian Armed Forces personnel at risk for moral injury.

Background: A link between moral injury (i.e., the psychological distress caused by perceived moral transgressions) and adverse mental health outcomes (AMHO) has been recently proposed. However, the prevalence of exposure to morally injurious events and the associated risk of experiencing AMHO remains understudied.
Method: The impact of exposure to potentially morally injurious experiences (PMIEs) was explored in relation to past-year PTSD and MDD, using the 2013 Canadian Armed Forces Mental Health Survey dataset of Afghanistan mission deployed regular force and reserve personnel. A series of logistic regressions were conducted, controlling for relevant sociodemographic, military, deployment, and trauma-related variables.
Results: Over half of the deployed personnel endorsed at least one PMIE. Several demographic and military variables were associated with exposure to PMIEs. Those exposed to PMIEs demonstrated a greater likelihood of having past-year PTSD and MDD; feeling responsible for the death of Canadian or ally personnel demonstrated the strongest association with PTSD and MDD. Mental health training was not a moderator for PMIE exposure and AMHO.
Conclusions: Exposure to PMIEs during deployments is common and represents an independent risk factor for past-year PTSD and MDD. Improved training that targets moral–ethical dilemmas and treatment interventions that address moral injury expressions is warranted.

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Key words: morals; ethics; stress disorders; post-traumatic; major depressive disorder; psychiatry; military; war-related injuries

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Significant Outcomes

- Exposure to potentially morally injurious events during deployments is common among military personnel and is associated with several military and sociodemographic variables.
- Exposure to potentially morally injurious events represents an independent risk factor for past-year PTSD and MDD, adjusting for relevant sociodemographic variables, childhood victimization, military factors, and other stressful deployment experiences.
- Pre- and postdeployment mental health education did not significantly moderate the relation between exposure to potentially morally injurious events and adverse mental health outcomes.

Limitations

- Detailed assessment of moral injury was not feasible in this large-scale epidemiological survey; our analysis explored the exposure to potentially morally injurious deployment-related stressful experiences as proxy measures for moral injury exposure.
- DSM-IV criteria were used to identify the presence of PTSD and depression.
- Expressions of moral injury are not limited to PTSD and depression; therefore, not all possible expressions of moral injury were assessed.

Introduction

Morals are deeply held beliefs of what is right, just, and fair (1, 2). As such, they form a central existential organizing principle that shapes our expectations concerning how we and others should act and how the world should function (3). In the military, these principles are codified in tenets such as international laws of armed conflict, the Geneva Convention and the just war theory (4) that provide an agreed upon moral foundation to separate war from barbarism. Not surprisingly, severe violations of one's deeply held personal beliefs concerning what is right, just, and fair can impair meaning-making and trigger a global redefinition of the individual's self-concept (5) or their worldview (3, 6). As threats to the 'integrity of one's internal moral compass' (6), these violations can result in 'crises of conscience ... or spirit' (7). Shay (8) introduced the term *moral injury* to describe such events which, with later refinements by Litz et al. (3), is now formally defined as the psychological distress experienced in response to perpetrating, observing and/or failing to prevent acts that transgress deeply held moral standards (e.g., feeling responsible for the death of an ally and being unable to help injured women and children) (3, 9, 10); see Nash and Litz (10) and Litz et al. (3) on the theorized process behind moral injury and its connections to possible behavioural manifestations.

While the traumatogenic nature of high-risk military deployment events such as combat is well-recognized (e.g., (11)), the impact of other deployment events such as those that increase the risk specific to the expression of moral injury is less well-understood. Still, despite the concept's nascent state, accumulating evidence suggests that military members exposed to events that they perceive to be morally transgressive (12) are at risk of developing post-traumatic stress disorder (PTSD), major depressive disorder (MDD), and suicidal ideation (see (13) for review). For instance, Vietnam veterans who reported that they had killed in a manner that was inconsistent with military ethics (e.g., reported killing women, children, the elderly, or prisoners; or committed what would be considered to be atrocities) had more severe PTSD symptoms than those who had killed in accordance with the laws of armed conflict (14). As well, researchers have suggested that moral injuries are associated with spiritual/existential issues (9, 15–17), withdrawal from social support systems (18–20), and a variety of chronic maladaptive behaviours, including 'self-harming behaviors such as poor self-care, alcohol and drug abuse, severe recklessness and parasuicidal behaviors' (3). The poor psychological and behavioural outcomes following moral injury are likely driven by shame and guilt (6, 15, 17, 21, 22) and worthlessness and self-blame (3, 18, 21), which together are thought to also drive poor treatment outcomes for many with PTSD.

Despite the emerging evidence on moral injury and its conceptual frameworks, treatment interventions for PTSD (with or without comorbid MDD and suicidal ideation) continue to center primarily on fear-based symptoms (23); such approaches may not be appropriate for ameliorating symptoms of guilt and shame in individuals suffering from moral injury (24). Not surprisingly, leading evidence-based therapies for military-related PTSD demonstrate limited efficacy; 30–50% of individuals suffering from military-related PTSD do not show clinically significant symptom reductions following psychotherapy (e.g., cognitive processing therapy and prolonged exposure) (25) and many military members who present with PTSD symptoms after deployment experience an exacerbation of symptoms over time (26, 27). Recent research suggests that moral injury may represent an independent risk factor for poorer outcomes in those already suffering from PTSD (28). To improve outcomes for individuals with PTSD who do not respond to existing treatments and to identify potential gaps in diagnostics, it is important to explore the prevalence and correlates of morally injurious experiences and their impact on mental health.

Research exploring the extent to which military personnel are exposed to morally injurious events is scarce and presents several challenges. First,

despite the existence of a few universals (e.g., thou shalt not kill), moral standards can differ across individuals, contexts, and time (29, 30); therefore, the perception of whether a certain event or behaviour transgresses a moral standard is, to a certain extent, variable. However, the existence of culture-related moral standards (e.g., see (31)) suggests that certain actions will generally be agreed upon as either morally right or wrong within particular groups. A second challenge to exploring exposure rates is that due to the inherent shame associated with the experience and its potential legal ramifications, some individuals may refuse to disclose moral transgressions; reports of morally injurious experiences may, therefore, be drastically underreported. This may be especially true of military personnel for whom such disclosure may lead to disciplinary action or even court-martial, although these concerns have been minimized in the past via the use of anonymous reporting (32, 33).

Notwithstanding these challenges, U.S. research has begun to explore the prevalence of morally ambiguous or transgressive situations that can be encountered during overseas military deployments. For example, in a survey of U.S. soldiers deployed in support of the Operation Enduring Freedom/Operation Freedom (OEF/OIF) (33), approximately 30% of the sample reported encountering morally ambiguous situations and were uncertain of the appropriate corresponding response (see also (34) for additional U.S. results). Results from a nationally representative survey of U.S. veterans indicate that over 10% of combat veterans reported moral transgressions by self, 25% witnessed transgressions by others, and 25% experienced betrayal (35). Moral dilemmas have been documented in other militaries as well (36, 37).

Aims of the study

Drawing from a nationally representative cohort of Canadian Armed Forces personnel, we aimed to (i) examine the prevalence of deployment-related, potentially morally injurious events among recently deployed Canadian Armed Forces personnel and identified the sociodemographic, military, and deployment-related factors associated with increased potentially morally injurious event exposure; (ii) explore whether exposure to potentially morally injurious events is associated with increased prevalence of post-traumatic stress disorder and major depressive disorder (i.e., potential expressions of moral injury); and (iii) explore whether mental health education moderates the relation between PMIE exposure and adverse mental health outcomes.

Methods

Participants

Data were drawn from the 2013 Canadian Forces Mental Health Survey (CFMHS), the most up-to-date, cross-sectional, nationally representative survey of mental health status and mental health service use in serving Canadian Armed Forces (CAF) personnel (38). The target sample of the 2013 CFMHS consisted of serving CAF Primary Reserve Force personnel deployed in support of the mission to Afghanistan (since its inception in 2001) and serving CAF Regular Force (RegF) personnel (irrespective of deployment status). The sampling frame was sourced from CAF military records and established in September 2012, with the survey being administered by Statistics Canada between April and August of 2013 via face-to-face interviews conducted on military bases during regular work hours. The 2013 CFMHS contains responses from a random sample of 6996 active RegF personnel and 1469 reservists, stratified by military component (regular vs. reserve), Afghanistan mission deployment status (yes or no), and current military rank (in three categories). Considering that our investigation centered on the effects of deployment-related experiences, our analysis was limited to RegF personnel and reservists previously deployed in support of the Afghanistan mission (unweighted sample size of 4854, representing 33 525 deployed personnel). Participation in this survey was voluntary, and informed consent was provided by all respondents. For more information on survey methodology and characteristics of the CAF's mission in Afghanistan, refer to Zamorski et al. (38). Ethical aspects of the data collection and data access were approved by the relevant review bodies within Statistics Canada that serve the functions of a Research Ethics Board.

Exposure and outcome measures

Clinical outcomes. Mental disorders in the 2013 CFMHS were assessed using the fully structured modules from the World Health Organization's Composite International Diagnostic Interview (CIDI, Version 3.0), in accordance with the definitions and diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV (39). Interviews were conducted by trained interviewers from Statistics Canada using the

computer-assisted person interviewing method (CAPI). The clinical outcomes of interest were the presence of past-year PTSD and MDD.

Potentially morally injurious experiences. The deployment experiences (DEX) module assessed exposure to eight stressful deployment experiences using dichotomous items sourced from the U.S. Walter Reed Army Institute of Research Combat Experiences Scale (40–42) and adapted by the Canadian Department of National Defence (DND). Items were selected from the original longer instrument by the survey's developers based on conceptual considerations and validation work published elsewhere using other datasets (43, 44). Following the same approach used in the CIDI trauma inventory (45), respondents were given a reference card with an indexed list of eight stressful deployment experiences and were asked to provide the ID(s) of any items that they have experienced while on deployment. Three stressful deployment-related experiences that may increase the risk for moral injury were identified and included in the analysis: DEX-4, 'seen ill or injured women or children who you were unable to help'; DEX-6, 'ever felt responsible for the death of Canadian or ally personnel'; DEX-8, 'had difficulty distinguishing between combatants and non-combatants'. These selected items align well with the expanding theoretical framework (3, 17) on the types of events that may cause moral injury. For instance, incidents involving risk of harm, actual harm, or death to others (in particular to civilians, allies, or those who are perceived to be innocent) have substantial moral–ethical connotations (e.g., violation of others' personal rights and freedoms, incongruity between outcome and prosocial intentions, and failure of duty to protect the innocent); exposure to such experiences may lead to perceived transgressions of personal moral values and standards.

Covariates

Sociodemographic factors (age, sex, primary language (as determined by the language of interview), marital status, the highest level of education, current difficulty meeting basic expenses), military variables (rank, component), history of childhood victimization, and deployment-related factors were controlled for in our analyses. History of childhood victimization (physical abuse, sexual abuse, exposure to intimate partner violence (IPV)) before the age of 16 was assessed using items and binary classification criteria from the Childhood Experiences of Violence Questionnaire (46), a well-validated measure of youth victimization used in other epidemiological research (e.g., 2012 Canadian Community Health Survey—Mental Health) (47). Deployment-related covariates were sourced from linked administrative data and included the location and cumulative duration of deployments in support of the mission to Afghanistan. The time interval between the last Afghanistan-related deployment and the survey administration date was also taken into account. Exposure to other stressful deployment-related experiences was assessed by the DEX module (e.g., 'ever been injured', 'ever received incoming artillery, rocket, or mortar fire'—see Table 3 for the entire list).

Effect modifier

Starting in 2008, CAF personnel began receiving mental health education (MHE) that targeted mental health literacy, stress management skills, and attitudes toward mental health treatment (for more information, see the Road to Mental Readiness (R2MR) programme (48)). As of September 2009, the dissemination of the MHE programme was widened across military members' entire career and had content tailored for specific contexts, including the deployment cycle. The implementation and delivery of deployment-specific R2MR were consistent across Reserve and Regular Force members. The 2013 CFMHS assessed whether respondents received various forms of MHE within the past 5 years of the interview date. Our analysis specifically explored whether the presence of deployment-specific MHE (i.e., in preparation for, or following, a deployment) was an effect modifier in the relation between exposure to PMIEs and adverse mental health outcomes (i.e., past-year PTSD and MDD).

Statistical methods

Logistic regression models were constructed to examine (i) sociodemographic, military, and deployment-related predictors of exposure to PMIEs; and (ii) the unadjusted and adjusted impact of exposure to PMIEs on the risk of past-year PTSD and MDD. Adjusted odds ratios (AOR) for past-year PTSD and MDD were calculated from the model controlling for relevant confounders (see Covariates section). AORs indicate the odds of an outcome (e.g., presence of past-year PTSD) given a specific exposure (e.g., exposure to a stressful deployment event) compared to the odds of an outcome (e.g., presence of past-year PTSD) without the specific exposure (e.g., no exposure to a stressful deployment event),

controlling for other covariates. Potential collinearity was assessed prior to model construction. Model and predictor significance were assessed using the Wald chi-square tests. To ensure our results would be representative of the entire CAF population deployed to Afghanistan, final survey weights that had been calculated by Statistics Canada and applied to each respondent were used in all analyses. To account for the complex survey design, variance calculations were conducted using bootstrap technique with replicate weights (500 bootstrap samples) provided by Statistics Canada (49). Effect modification was tested using a multiplicative interaction term. We used complete-case analysis through listwise deletion, yielding an exclusion of 1–5% of respondents, depending on the variables included in the models. All analyses were conducted with *SAS® 9.4* (SAS Institute Inc., Cary, NC, USA) statistical software with an alpha level set at 0.05.

Results

Sociodemographic and military characteristics of the study sample are found in Table 1 and 2 respectively. Among CAF personnel deployed in support of the mission to Afghanistan, past-year PTSD and past-year MDD were present in 7.6% and 9.2% of the population respectively. Over half of the deployed personnel (58%) endorsed at least one PMIE. Specifically, 43% reported seeing ill or injured women or children who they were unable to help, 7% felt responsible for the death of Canadian or ally personnel, and 38% reported having difficulty distinguishing between combatants and noncombatants (see Table 3 for the prevalence of other stressful deployment-related experiences assessed in this survey). Proportions of the sample reporting PMIEs across different sociodemographic and military characteristic are found in Table S1.

Logistic regression models for the occurrence of PMIEs are reported in Table 4. Endorsement of at least one PMIE was statistically significantly associated with being younger (AORs: 1.38–1.97; see Table 4 for all 95% confidence intervals (CI)); relative to the 45–60 age group), male (AOR: 2.00; 95% CI: 1.59–2.50), having difficulty meeting basic expenses (AOR: 1.60; 95% CI: 1.18–2.17), having a history of childhood physical abuse (AOR: 1.37; 95% CI: 1.17–1.60), being deployed to Kabul (AOR: 5.56; 95% CI: 4.22–7.32), Kandahar

Table 1. Sociodemographic and clinical characteristics of the study sample (sample size = 4854; Weighted *N* = 33525)

Variable	Weighted Estimate % of personnel (95% CI)
Age	
17–24	4.06 (3.43–4.69)
25–34	36.58 (35.23–37.92)
35–44	34.43 (33.11–35.74)
45–60	25.00 (23.80–26.20)
Sex	
Male	89.20 (88.20–90.20)
Female	10.80 (9.80–11.80)
Primary language	
English	76.73 (75.47–77.99)
French	23.33 (22.07–24.59)
Marital status	
Married	52.03 (50.54–53.52)
Common law	20.70 (19.45–21.96)
Separated, widowed, or divorced	8.41 (7.54–9.28)
Single	18.85 (17.73–19.98)
Highest education level	
Secondary or lower	33.45 (31.99–34.91)
Postsecondary or higher	66.55 (65.09–68.01)
Difficulty meeting basic expenses	6.28 (5.55–7.02)
History of childhood victimization	
Physical	45.18 (43.61–46.76)
Sexual	7.37 (6.57–8.16)
Exposure to IPV	10.17 (9.27–11.06)
Presence of past 12-month diagnoses	
Post-traumatic stress disorder	7.60 (6.73–8.46)
Major depressive disorder	9.20 (8.24–10.16)

CI, confidence interval; IPV, intimate partner violence. Due to Statistics Canada rounding guidelines, some proportions may not sum to 100.00%.

Table 2. Military and deployment characteristics of the study sample

Variable	Weighted Estimate % of personnel (95% CI)
Military factors	
Component	
Regular force	86.69 (86.61–86.78)
Reserve force	13.37 (13.28–13.45)
Rank	
Junior NCM	48.21 (47.74–48.68)
Senior NCM	31.74 (31.35–32.14)
Officer	20.05 (19.78–20.31)
Deployment-related factors	
AFG deployment location	
Kabul	11.40 (10.38–12.43)
Kandahar	55.46 (53.96–56.96)
Multiple locations	14.57 (13.53–15.61)
Other locations	18.57 (17.33–19.80)
Cumulative duration of AFG deployment(s)	
≤120 days	13.67 (12.60–14.74)
121–240 days	57.25 (55.74–58.77)
241–360 days	14.15 (13.04–15.25)
>361 days	14.93 (13.85–16.00)
Presence of MHE	
Predeployment MHE	57.24 (55.76–58.72)
Postdeployment MHE	62.67 (61.18–64.15)
Interval between last AFG deployment and survey administration date	
<4 years	31.70 (30.26–33.14)
4 years	16.60 (15.48–17.71)
5 years	20.42 (19.18–21.65)
6 years	9.37 (8.46–10.29)
>7 years	21.91 (20.70–23.12)

AFG, Afghanistan; CI, confidence interval; NCM, noncommissioned member; MHE, mental health education. Due to Statistics Canada rounding guidelines, some proportions may not sum to 100.00%.

Table 3. Proportion of study sample endorsing exposure to potentially morally injurious and other stressful deployment experiences

Stressful deployment experiences	Weighted estimate % of personnel (95% CI)
PMIEs	
DEX-4. Seen ill or injured women or children who you were unable to help	42.64 (41.06–44.23)
DEX-6. Ever felt responsible for the death of Canadian or ally personnel	7.42 (6.59–8.24)
DEX-8. Had difficulty distinguishing between combatants and noncombatants	38.40 (36.85–39.95)
Any PMIE	57.66 (56.07–59.24)
Other stressful deployment experiences	
DEX-1. Ever known someone who was seriously injured or killed	70.51 (69.13–71.90)
DEX-2. Ever found yourself in a threatening situation where you were unable to respond because of the rules of engagement	31.22 (29.84–32.60)
DEX-3. Ever been injured	25.42 (24.14–26.70)
DEX-5. Ever received incoming artillery, rocket, or mortar fire	70.51 (69.09–71.93)
DEX-7. Ever had a close call, for example, shot or hit but protective gear saved you	26.02 (24.70–27.33)

CI, confidence interval; DEX, stressful deployment experience; PMIE, potentially morally injurious experience.

(AOR: 5.16; 95% CI: 4.11–6.48), or multiple locations (AOR: 4.17; 95% CI: 3.09–5.64) relative to other locations, and having a longer cumulative duration of Afghanistan deployment(s) (AORs: 1.34–2.11; see Table 4 for all 95% CIs). Having an Afghanistan deployment within 4 years of the survey administration (relative to having the most recent Afghanistan deployment more than 7 years prior to the date of survey administration) or being a junior rank NCM (relative to being an officer) generally decreased the likelihood of PMIE endorsement (AORs: 0.79 and 0.70, respectively, although the pattern for military rank differed for DEX-4, as reported in Table 4).

Logistic regression models for the association between exposure to PMIEs and the presence of past-year PTSD and MDD are found in Table 5 (full regression models are found in Table S2). Controlling for sociodemographic, military, and deployment-related factors, all three PMIEs significantly increased the likelihood of having past-year PTSD and MDD (AORs between 1.33 and 2.90; see Table 5 for all AORs and 95% CI), with feeling responsible for the death of Canadian or ally personnel demonstrating the strongest association with PTSD and MDD (AORs: 2.90 (95% CI: 1.97–4.28) and 2.13 (95% CI: 1.45–3.13) respectively). Increased risk of past-year PTSD was also associated with being female, having difficulty meeting basic expenses, exposure to intimate partner violence during childhood, being an NCM, being in a threatening situation and unable to respond because of rules of engagement, and sustaining an injury. In comparison with individuals between the ages of 45 and 60, those between the ages of 17 and 24 were less likely to have past-year PTSD. Increased risk of past-year MDD was associated with being female, being separated, widowed, or divorced, having difficulty meeting basic expenses, having a history of childhood physical abuse, being an NCM (relative to being an officer), having an Afghanistan deployment within 4 years of the survey administration (relative to having an Afghanistan deployment more than 7 years prior to survey administration), and sustaining an injury. No other variables included in our models significantly predicted past-year PTSD or MDD.

Exposure to pre- or postdeployment MHE was not found to be a significant effect modifier in the logistic regression models for the risk of past 12-month PTSD or past 12-month MDD; these MHE variables remained as covariates in our models (see Table S2). Despite the lack of effect modification, there was a trend toward more favorable mental health outcomes in deployed personnel who had undergone predeployment MHE.

Discussion

Using a nationally representative sample of active, deployed military personnel, we identified the prevalence and predictors of deployment-related potentially morally injurious experiences (PMIEs). Further, we examined whether exposure to PMIEs was associated with an increased risk of past-year PTSD and MDD.

Prevalence and predictors of PMIEs

We found that among deployed CAF personnel, over half of the population reported at least one deployment-related PMIE. The most commonly reported PMIE was related to seeing ill or injured women or children whom they were unable to help (43%), followed by the difficulty distinguishing between combatants and noncombatants (38%) and feeling responsible for the death of a Canadian or ally personnel (7%). Our results align with recent efforts to capture the prevalence of moral injuries among U.S. combat veterans. Specifically, Wisco et al. (35) found that over 40% of a nationally representative sample of combat veterans endorsed at least one item on the Moral Injury Events Scale (MIES), a self-report measure intended to capture exposure to moral injury. The rates of exposure to PMIEs obtained from our analysis are almost double of those published in a previous report by Sudom et al. (44) that explored

Table 4. Multiple logistic regression models of the association between exposure to potentially morally injurious experiences and sociodemographic, military, and deployment factors

	AOR† estimates and confidence intervals							
	Any PMIE		DLX-4		DLX-6		DLX-8	
Characteristics	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Sociodemographic factors								
Age								
17–24	1.97**	1.28–3.03	1.54*	1.04–2.30	1.53	0.75–3.13	1.64*	1.10–2.45
25–34	1.38**	1.12–1.69	1.18	0.97–1.43	1.44	0.98–2.11	1.19	0.97–1.48
35–44	1.44***	1.19–1.75	1.42***	1.18–1.70	1.18	0.83–1.66	1.21*	1.00–1.48
45–60	Reference		Reference		Reference		Reference	
Sex								
Female	0.50***	0.40–0.63	0.69**	0.55–0.88	0.93	0.60–1.42	0.30***	0.23–0.40
Male	Reference		Reference		Reference		Reference	
Primary language								
French	1.07	0.89–1.28	1.14	0.96–1.36	0.93	0.69–1.26	0.94	0.78–1.12
English	Reference		Reference		Reference		Reference	
Marital status								
Common law	0.96	0.79–1.16	0.96	0.79–1.16	1.08	0.79–1.48	0.98	0.81–1.18
Separated, widowed, or divorced	0.92	0.72–1.17	1.05	0.83–1.33	0.72	0.44–1.18	0.92	0.72–1.18
Single	0.97	0.79–1.20	1.01	0.83–1.23	1.08	0.78–1.52	0.94	0.77–1.14
Married	Reference		Reference		Reference		Reference	
Highest education level								
Postsecondary education or higher	0.98	0.84–1.14	0.97	0.83–1.13	1.14	0.86–1.53	0.96	0.82–1.13
Secondary or lower	Reference		Reference		Reference		Reference	
Difficulty meeting basic expenses								
Yes	1.60**	1.18–2.17	1.23	0.94–1.61	1.85**	1.20–2.85	1.53**	1.15–2.04
No	Reference		Reference		Reference		Reference	
History of childhood victimization								
Physical	1.37***	1.17–1.60	1.38**	1.19–1.60	1.63***	1.28–2.07	1.30***	1.12–1.51
Sexual	1.31	0.97–1.78	1.38*	1.04–1.85	1.20	0.75–1.95	1.26	0.92–1.72
Exposure to IPV	1.22	0.94–1.59	1.25	0.99–1.58	1.34	0.92–1.95	0.88	0.67–1.14
Military factors								
Component								
Reserve Force	1.14	0.99–1.32	1.13	0.98–1.30	0.92	0.71–1.20	1.20*	1.04–1.38
Regular Force	Reference		Reference		Reference		Reference	
Rank								
Junior NCM	0.70***	0.57–0.86	0.97	0.80–1.17	0.58**	0.42–0.81	0.71***	0.58–0.87
Senior NCM	1.10	0.90–1.33	1.33**	1.11–1.61	0.72	0.52–1.02	0.98	0.81–1.18
Officer	Reference		Reference		Reference		Reference	
Deployment-related factors								
AFG deployment location								
Kabul	5.56***	4.22–7.32	4.34***	3.24–5.80	3.01**	1.32–6.89	5.22***	3.80–7.17
Kandahar	5.16***	4.11–6.48	3.55***	2.76–4.56	7.50***	3.84–14.63	5.65***	4.28–7.47
Multiple locations	4.17***	3.09–5.64	3.00***	2.22–4.06	4.81***	2.25–10.28	4.83***	3.48–6.71
Other locations	Reference		Reference		Reference		Reference	
Cumulative duration of AFG deployment(s)								
≤120 days	Reference	Reference	Reference	Reference				
121–240 days	1.34**	1.08–1.66	1.32*	1.07–1.63	1.96**	1.24–3.09	1.29*	1.03–1.61
241–360 days	1.38*	1.05–1.82	1.39*	1.06–1.82	1.80*	1.02–3.16	1.28	0.97–1.68
>361 days	2.11***	1.58–2.83	1.83***	1.37–2.43	2.33**	1.40–3.86	1.88***	1.41–2.52
Interval between last AFG deployment and data collection date								
<4 years	0.79*	0.64–0.99	0.81	0.66–1.01	0.59*	0.40–0.89	0.91	0.73–1.15
4 years	1.01	0.79–1.29	0.94	0.74–1.20	0.99	0.65–1.50	1.03	0.80–1.32
5 years	1.24	0.99–1.55	1.26*	1.01–1.56	0.87	0.57–1.34	1.04	0.83–1.31
6 years	1.20	0.92–1.58	1.07	0.82–1.39	0.98	0.61–1.60	1.21	0.92–1.59
>7 years	Reference		Reference		Reference		Reference	

AFG, Afghanistan; AOR, adjusted odds ratios; DLX-4, seen ill or injured women or children who you were unable to help; DLX-6, ever felt responsible for the death of Canadian or ally personnel; DLX-8, had difficulty distinguishing between combatants and noncombatants; IPV, intimate partner violence; MDD, major depressive disorder; MHL, mental health education; NCM, noncommissioned member; PMIE, potentially morally injurious experience; PTSD, post-traumatic stress disorder. Reference category for history of childhood victimization, presence of MHL, and exposure to other stressful deployment experiences: no exposure/presence of corresponding item.

*$0.01 < P \leq 0.05$.

**$0.001 < P \leq 0.01$.

***$P < 0.001$.

†Multiple logistic regressions, adjusting for the other variables shown in the table.

Table 5. Association between exposure to potentially morally injurious deployment experiences and the presence of past 12-month post-traumatic stress disorder and depression

	Past-year PTSD		Past-year MDD	
PMIEs	OR (95% CI)	AOR† (95% CI)	OR (95% CI)	AOR† (95% CI)
DLX-4. 'Unable to help ill or injured . . .'	3.19 (2.45–4.14)***	1.50 (1.07–2.11)*	2.06 (1.66–2.54)***	1.33 (1.00–1.76)*
DLX-6. 'Felt responsible for death of ally/Canadian pers. . .'	5.21 (3.91–6.93)***	2.90 (1.97–4.28)***	3.19 (2.32–4.38)***	2.13 (1.45–3.13)***
DLX-8. 'Difficulty distinguishing combatants. . .'	2.91 (2.26–3.74)***	1.70 (1.24–2.31)***	2.09 (1.70–2.58)***	1.70 (1.31–2.20)***

AOR, adjusted odds ratios; CI, confidence interval; DLX-4, seen ill or injured women or children who you were unable to help; DLX-6, ever felt responsible for the death of Canadian or ally personnel; DLX-8, had difficulty distinguishing between combatants and noncombatants; MDD, major depressive disorder; OR, odds ratios; PMIE, potentially morally injurious experience; PTSD, post-traumatic stress disorder.

*$0.01 < P \leq 0.05$.

**$0.001 < P \leq 0.01$.

***$P \leq 0.001$.

†Multiple logistic regression; adjusted for sociodemographic variables, military factors, history of childhood victimization, presence of deployment-related mental health education, and deployment-related variables (e.g., other stressful experiences). See Table S2 for full model.

the occurrence of stressful deployment experiences among all CAF personnel deployed to Kandahar between 2009 and 2012. The stark contrast between the findings is likely due to the decrease in threat level experienced in Kandahar after 2010, along with methodological differences.

Several sociodemographic and military factors were associated with an increased likelihood of exposure to PMIEs. We found that men were more likely to report exposure to PMIEs during a deployment compared to women, a finding that aligns with previous research reporting lower exposures to war-related stressors in women (50, 51). Considering that women represent 14% of the CAF population but only 2.1% of combat arms roles (52), the sex differences in exposure to PMIEs are likely due to female military members occupying more support-related roles and operating in less dangerous environments during deployments. Furthermore, we found that younger individuals were more likely to be exposed to PMIEs in comparison with those who were between the ages of 45 and 60 years old. Age and sex differences in sensation-seeking (53) may, in part, explain these findings. We found that the likelihood of exposure to PMIEs differed depending on the geographical region of deployment. Specifically, those who deployed to Kabul and Kandahar were more likely to be exposed to PMIEs compared to individuals who deployed to other locations in support of the mission to Afghanistan. The Afghan cities of Kabul and Kandahar experienced the highest levels of threat and hostility during the 2001–2013 deployments to Afghanistan. Combined with a large civilian population, high urban density, the presence of unmarked enemy combatants, and inherent risk of civilian casualties, these deployment regions represented a complex operating environment that may have placed significant physical, cognitive, and moral–ethical demands on military members deployed to these areas. Indeed, a previous study showed that CAF members deployed to combat-heavy zones within Afghanistan (i.e., Kandahar) demonstrated a heightened risk of developing a deployment-related mental disorder within 6 years of returning from the first deployment (11). The reduced endorsement of PMIEs by individuals who have completed an Afghanistan deployment within 4 years of the survey (relative to an earlier deployment date) may be due to the lessened hostility experienced in the final years of the mission to Afghanistan.

Impact of PMIEs on mental health outcomes

Our results suggest that the exposure to PMIEs may increase the risk of PTSD and MDD independent of other military and sociodemographic variables. Critically, our results are not confounded by exposure to other stressful deployment experiences such as being involved in combat or sustaining an injury (see Table S1 for all controlling variables).

We found that members who reported difficulties distinguishing between combatants and noncombatants were 1.7 times more likely to present with PTSD and MDD in the past year (controlling for other military, sociodemographic, and deployment-related factors). The ability to discriminate between combatants and noncombatants is a core principle of legal and moral conduct of war and parallels the Geneva Convention stipulation concerning the safety of the civilian population (e.g., 'individual civilians shall not be the object of attacks' and that 'indiscriminate attacks are prohibited') (54, 55). Military members who have difficulties discriminating between combatants and civilians, particularly during time-sensitive or life-threatening situations, may experience distress as a result of the uncertainty surrounding the most appropriate and moral action; distress may be

exacerbated if members question their decision-making and experience regret or guilt following their action. Considering that irregular warfare (i.e., violent struggle conducted in part by nonstate actors and unmarked combatants who may intentionally blend into civilian populations (56)) is on the rise (57), we expect our armed forces members to encounter this discrimination ambiguity at a higher rates in future deployments and, as a consequence, a larger proportion of the deployed population may be at an elevated risk of experiencing adverse mental health outcomes.

We found that military members who endorsed ever feeling responsible for the death of an ally or Canadian personnel were almost three times more likely to present with past-year PTSD and over two times more likely to present with past-year MDD in comparison with those not endorsing this experience. Our results are consistent with previous literature demonstrating an association between killing in combat and several adverse mental health outcomes, such as PTSD (58), MDD (59), suicidal ideation (28, 60), and suicide attempts (28, 58). Furthermore, research with treatment-seeking U.S. veterans has suggested that experiences of killing may be associated with heightened symptoms of shame, guilt, dissociation, loss of religious faith, and functional impairment (59, 61). Although this PMIE was endorsed by a small segment of the deployed CAF population (7%), due to its extensive risk for PTSD and MDD, it represents an important screening target for prospective monitoring and early intervention.

Deployed CAF members who endorsed seeing ill or injured women or children whom they were unable to help were 1.5 times more likely to have past-year PTSD and 1.3 times more likely to have past-year MDD than members who did not endorse this experience. The inability to help others in need may violate one's perceived duty to protect the innocent and may induce dissonance between their actions, environment, and the intended prosocial intentions of the mission. Those tasked to provide security and stabilization to a civilian region may find vicarious exposure to such trauma particularly distressing. The inability to help others has been previously shown to be related to future psychopathology (62) and may also, in part, be explained by the negative state relief model, which postulates that individuals experiencing stress or adversity may increase their sense of control and coherence (i.e., sense that they are capable of meeting demands of their environment and that engagement with these demands are worthy and justifiable; see Antonovsky (63)) by helping others (64, 65). Further research exploring the link between the sense of coherence, stressful deployment experiences, moral injury, and wellbeing is warranted.

Considering how common it is for CAF military members to experience a deployment event that could be considered to be morally injurious, and as highlighted here, their significant negative impact on mental health, such moral ethical dilemmas and challenges must be thoroughly explored and addressed during training and postoperational debriefings. Our recommendation aligns with previous calls to improve moral–ethical decision-making training and rehearsal in military members (66). Furthermore, common PTSD treatments are not focused on targeting symptoms associated with moral injury expression largely because the clinical and research landscape has long considered PTSD to be fear-based (67). While some existing treatments (e.g., cognitive processing therapy) have been designed to address certain concerns present among those with moral injuries, common PTSD therapies are not always effective, indicating the need to innovate and consider alternative approaches to enhance and strengthen treatment response; such approaches should ensure that the full symptomatological profile associated with moral injury expression is targeted and that treatment-seeking personnel have the cognitive and affective resources to commit to treatment (e.g., via motivational interviewing prior to treatment and mindfulness-based approaches). Fortunately, significant strides have recently been made in increasing awareness of moral injury within the military medical and research community; this has spurred novel treatments tailored to address symptoms related to this concept (24, 68), with efficacy trials currently underway (69). Future studies should continue to capture the prevalence of exposure to stressful deployment-related events, assess corresponding affective responses, track temporal trends, and carefully characterize the military sample and nature of deployments—such research will elucidate the environmental and individual moderating and mediating factors in the relation between objective exposures to stressful events and the expressions of moral injury (e.g., PTSD and MDD). Ultimately, such scientific evidence will further guide military policies and establish strategies to reduce the risk of experiencing moral injury.

Several sociodemographic variables within our model were related to past-year PTSD and MDD. Although we found that female military members were less likely to endorse PMIEs than men, women were more likely to present with past-year

PTSD and MDD when controlling for PMIEs exposure and other covariates. Our findings are consistent with past research showing that female sex is an independent risk factor for PTSD (70) and MDD (71). The relation between sex and MDD risk in this population may, in part, be attributable to differences in perceived work stress, considering that in another nationally representative CAF study by Mota et al. (50), the association between sex and MDD diagnosis failed to reach significance after controlling for stressful deployment-related exposures and work-related stress. Our finding of decreased likelihood of having past-year PTSD by those who are younger (i.e., 17–24 years old) aligns with a previous study reporting favorable mental health outcomes in younger deployed CAF members (72) but is at odds with a recent meta-analysis reporting a null association between age and military-related PTSD (73). Several factors may be at play. First, younger individuals have lower cumulative lifetime exposure to trauma and loss and, therefore, may be less likely to experience a traumatic event that results in PTSD. Second, some studies have found that among traumatized individuals, those high in sensation-seeking were less likely to develop PTSD compared to those with low sensation-seeking (74). Largely speculative in nature, it may be possible that the heightened sensation-seeking generally present among men and younger individuals exerts a protective effect against stress-related psychopathology (75). Finally, younger cohorts or those members who have recently joined military service may be hesitant to disclose PTSD symptomatology for fear of potential career repercussions (e.g., beliefs that they may not be deployable in the future due to a diagnosis of PTSD).

Neither pre- nor postdeployment mental health training was found to significantly reduce the risk of past-year PTSD and MDD in this population, although a trend in the favorable direction was visible (for both pre- and postdeployment MHE). Despite many militaries implementing a wide range of mental health training and resilience programmes (e.g., Battlemind, BattleSmart, TRiM, R2MR; see Vermetten et al. (76) for a review), evidence behind their efficacy is limited (77, 78); longitudinal randomized controlled trials are highly warranted to confirm that resilience training provides the intended protective benefit on mental health without inadvertent negative effects on other outcomes (e.g., unit cohesion). With respect to moral injury specifically, as mentioned earlier, our results may also suggest the need for training that is more directly focused on moral challenges or dilemmas that may be encountered in operations (34) and may include emotionally salient and immersive moral decision-making scenarios embedded in high-intensity battlefield training (66).

Limitations

There are several limitations to this study. First, considering that the CFMHS is a general, large-scale survey of mental health and mental health service use in active CAF personnel, the detailed assessment of moral injury was not feasible; our analysis explored the exposure to potentially morally injurious deployment-related stressful experiences as proxy measures for moral injury. Specifically, from a list of eight stressful deployment-related experiences present in the DEX module, we identified three events/items that, according to the current conceptualization of moral injury, would likely increase the risk for experiencing moral injury. We recognize that the deployment-related experiences included in the DEX module and the items selected as proxy measures for moral injury are nonexhaustive—military members may have experienced other stressful or morally injurious events during a deployment that were not captured by the survey. Furthermore, whereas two of the three DEX items included as PMIEs relied on the respondent to make largely cognitive-based appraisals of their experiences (e.g., seeing ill or injured women or children who you were unable to help; unable to distinguish between combatants and noncombatants), one DEX item addressed a more subjective and affective appraisal of an experience (i.e., DEX-6: *feeling responsible* for the death of an ally or Canadian personnel); this item more closely captures the essence of moral injury as it alludes to potential feelings of guilt and shame related to the perceived responsibility for the death of an innocent individual. Although our study controlled for the history of childhood victimization, due to methodological limitations of the survey, we were unable to control for exposure to trauma that occurred during adulthood and outside of the deployment context. Furthermore, we did not explore leadership, morale, or cohesion as covariates or effect modifiers in our analysis. Considering that those with mental disorder diagnoses are at a disproportionate risk for release from service (79), the deployed cohort may have had a depleted representation of those with established mental disorders at the time of survey administration. Limitations pertaining to MHE include the fact that the content of MHE did not necessarily focus on moral injury and that the impact of MHE was assessed through a simplistic dichotomization of MHE exposure (i.e., the

heterogeneity of content, delivery, and duration was not taken into account).

Limitations within the DSM-IV diagnostic criteria are also relevant. According to the DSM-IV, a diagnosis of PTSD requires one to experience fear, helplessness, or horror in response to trauma exposure (Criterion A2); however, the validity of this mandatory criterion has been scrutinized (80–82). Emerging research on the role of shame and guilt in PTSD suggests that Criterion A2 does not capture the full range of peri-traumatic experiences one may undergo (e.g., guilt, shame, and dissociation) nor does it account for a delay in the presentation of these experiences. Furthermore, as we are exploring PTSD within a military sample, military training may have intentionally prevented individuals from experiencing immediate incapacitating emotions that may compromise the success of operations under stressful conditions. Due to the conditional logic of question presentation in the survey, we were unable to explore the impact of excluding Criterion A2 on past-year PTSD prevalence. Future studies exploring moral injury, shame, or guilt in PTSD must be mindful of the DSM-IV Criterion A2 and its potential impact on inflating false-negatives when implementing PTSD assessments that follow DSM-IV guidelines (80).

Overall, it is becoming evident that expressions of moral injury may not adequately reside within the diagnostic boundaries of PTSD as defined by the DSM. Accumulating research suggests that inner conflict brought on by perceived moral transgressions may be related to a breadth of adverse mental health outcomes, such as PTSD, MDD, suicidal ideation, and spiritual distress (24, 28, 35, 60), indicating that the trajectory from morally injurious exposure to its adverse psychological manifestation may have different routes and lead to diverse expressions. The diagnostic ambiguity relating to moral injury increases the risk that some individuals do not receive timely and appropriate care. To advance our understanding of moral injury, it may be beneficial to consider it as a standalone construct (9, 28) rather than attempting to subtype it under PTSD. Furthermore, by delineating moral injury from PTSD, we may maintain the applicability of current fear-based models of PTSD and its associated treatments that have largely been successful at ameliorating fear-based PTSD.

The disclosure of moral injuries is a sensitive issue for several reasons. Ambiguity regarding legal and career ramifications following disclosure of certain morally conflicting events (e.g., intentionally disobeying orders to prevent atrocities and observing morally questionable behaviours by others) may discourage open dialogue within treatment and research settings. Compounding this issue, individuals may already be hesitant to disclose moral injuries due to the inherent feelings of shame and fear of judgment. Accordingly, lack of perceived or actual anonymity and participant–researcher confidentiality may preclude comprehensive investigations into the true prevalence and nature of moral injury; the use of anonymized surveys and official legal protection (e.g., Certificate of Confidentiality via the National Institute of Health), where available, is highly recommended. Legal obligations of the research team regarding compelled third-party disclosure (e.g., law enforcement and employer) must be thoroughly explained during the consent process. Data for this study were collected via in-person interviews held on military bases during regular working hours and are acknowledged as a limitation.

To conclude, notwithstanding the limitations, our results demonstrate that exposure to potentially morally injurious events during deployments is common among military personnel and represents an independent risk factor for past-year PTSD and MDD; pre- and postdeployment mental health education did not ameliorate this risk. Our results highlight the need to capture the prevalence of moral injuries in military populations, effectively address moral ethical dilemmas commonly encountered during deployments, and ensure that early interventions and mental health treatments are sensitive to moral injury.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table S1. Proportions (%-95% CI) reporting potentially morally injurious experiences among CAF personnel deployed in support of the mission to Afghanistan-by sample characteristics.

Table S2. Full regression model for the presence of past-12 month posttraumatic stress disorder and major depressive disorder.

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